Research Project

CHEW (Carbon-Hungry ricE and Wheat)

Objectives

The concentration of CO2 in the atmosphere has dramatically increased since the pre-industrial period and may, within the next few decades, reach 600 ppm irrespective of the ongoing policies to reduce human-based C emission. This increase is expected to promote crop yield in particular in C3 species (whose photosynthesis directly depends on external CO2 concentration) as predicted by experiments under elevated CO2 (eCO2) and model projections. However, there is also growing evidence that C3 cereals tend to be carbon sink limited under eCO2 due to the inability of sinks such as reproductive parts to benefit from additional C available, causing a downregulation of photosynthetic called acclimation. Large gains in eCO2 yield response are therefore expected if sink eCO2 responsiveness can be selected for. As costs of breeding in CO2 FACE field trials are prohibitive, proxy traits able to predict eCO2 sink response based on evaluation under current CO2 could be of high value to orientate breeding towards genotypes making the most of eCO2.

CHEW aims to provide validated, predictive proxies for two major cereals of world diet, rice and wheat. The project team will search for such proxies under the specific conditions these species are most often encountering in the field: flood for rice and water-limitation for wheat. The later condition is of high interest because drought is expected to further limit sink strength more than photosynthesis (source). Genetic diversity of sink:source trait interactions and plasticity will be studied under current (400) and projected (600 ppm) [CO2]. Drought effects will be studied at vegetative and grain filling stages. Different acclimation processes will be analyzed and modelled, involving photosynthetic regulation, CHO pools, developmental and morphological plasticity, and N- dilution due to enhanced growth.

Duration

Jan 2022 – Dec 2023

Leader

Michael Dingkuhn (Cirad, AGAPInstitut Leader)

Denis Fabre (Cirad, AGAPInstitut) and Bertrand Muller (Inrae, LEPSE) (co-coordinators)

Geographical Dimension

France (CIRAD and INRAE) - Montpellier

Partners

CIRAD-INRAE-WUR

Funding :

Agropolis Foundation

Keywords

Acclimation to enhanced [CO2], Acclimation, Proxy traits, Sink-source relationships, Photosynthesis, Water deficit.